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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

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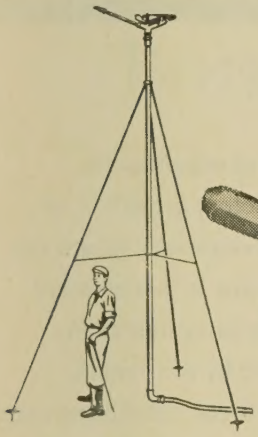

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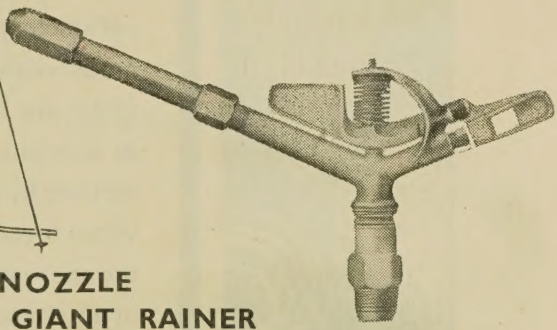

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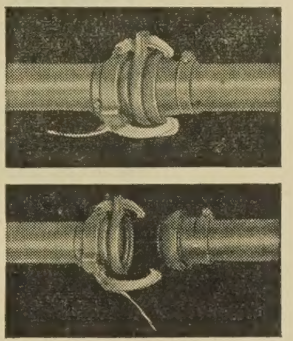

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MINISTRY OF
AGRICULTURE, FISHERIES AND FOOD

Cabbages Brussels Sprouts

AND OTHER GREEN CROPS

Bulletin No. 132

LONDON
HER MAJESTY'S STATIONERY OFFICE
1960

Foreword

THE pattern of commercial production of the various cabbage crops is broadly similar in practice, though with differences in detail on account of climate and custom and the special needs of the particular crops themselves. In this bulletin a general account of the production of cabbage crops is given, followed by sections dealing with the special cultural requirements of each particular crop. Local practices and custom and other matters of interest in the main production areas are considered in a separate section.

The Vegetable Group of the National Agricultural Advisory Service, under the chairmanship of Mr. W. G. Hume, is generally responsible for the information contained in this new edition of the bulletin.

The information on pests and diseases is the responsibility of the Ministry's Plant Pathology Laboratory.

Ministry of Agriculture, Fisheries and Food
July 1960

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Cabbages and Savoys

Varieties

As varietal names in themselves mean very little, it is all important to obtain a good stock of any variety that may be selected. Also it should be noted that a variety suitable for growing at one season of the year may be entirely unsuitable for another season. For example, a variety suitable for spring sowing may bolt if sown in the autumn, while a variety for autumn sowing may fail to heart if sowing is delayed until spring. Below is a list of market varieties suitable for different seasons and purposes. For production of the various kinds of cabbage throughout the year in the south of England, Appendix I should be consulted.

Spring Cabbage

Hearting Cabbage — Very Early Hearting (small hearts): Harbinger.

Early Hearting (small to medium hearts); Early Offenham, Spring Glory.

Maincrop Hearting (medium to large hearts): Durham Early, Early Spalding, First Early Market 218, Spalding Market.

Spring Greens — Spalding Market, Early Spalding, Ideal Early, Early Giant, Spring Glory.

Summer Cabbage

Primo, June Giant, Golden Acre, Greyhound.

Autumn Cabbage

Winnigstadt.

Winter Cabbage

Christmas Drumhead, January King.

Savoys

Early (September–November): Green Curled, Best of All.
Second Early (October–December): Best of All, Ormskirk Early.
Mid-season (November–January): Ormskirk Medium, Alexander's No. 1.
Late Mid-season (December–February): Alexander's No. 1, Omega, Ormskirk Late.
Late (January–March): Omega, Ormskirk Late, Ormskirk Extra Late.
Extra Late (February–April): Ormskirk Extra Late.

Crop Rotation

Formerly, on mixed farms, brassica crops were grown only as cleaning or fallow crops which were fed off to livestock; now, by growing suitable varieties, they form useful catch crops which can still be fed to sheep or cattle when the fresh vegetable market is glutted. Consequently, in many parts of the country a brassica crop, particularly cabbage, is now a regular feature in the normal rotation, commonly replacing part of the root course.

In market gardening, cultivation is more intensive and crops follow one another much more closely than in the farm rotations. The place of the cabbage crop in the succession varies with different districts; the following of one brassica crop by another should, however, be avoided, as it increases the risk of carrying over pests and diseases from one crop to the next.

Generally speaking, in the south summer and autumn cabbage can follow other crops cleared by the end of April; winter cabbage and savoys follow the earliest cleared summer crops; spring cabbage follows the late summer crops or even early autumn ones such as onions or maincrop potatoes. In the north brassicas occupy the land for a longer period and it is often impossible to take another crop beforehand, especially as savoys and cabbage are best when planted on well consolidated land.

Soils and Manuring

Provided the land is well drained and in good heart, cabbages do well on a wide range of soils. The crop does best, however, on medium to light loams, if precautions are taken to prevent drying out. As cabbages are better able to withstand drought than Brussels sprouts or winter cauliflower they are often grown on land considered too light for these crops. For over-wintering crops particularly, the land must not be wet, otherwise they will fail or will be patchy, and with spring cabbage it may be impossible to cultivate wet cold land sufficiently early in the spring.

If the soil is acid, there is always a danger of infection with club root, which later on may make further production of commercial brassica crops highly speculative or even impossible. It is essential, therefore, to pay special attention to the lime requirements of the soil. Soil analysis is the best method of ascertaining how much lime, if any, should be added to the soil. Facilities for soil analysis are available at little or no cost to the grower and details can be obtained from the National Agricultural Advisory Service.

Land Preparation

All brassica crops benefit from thorough cultivations, and the vigour and quality of resulting crops are greatly influenced by the cultivations given before planting. Lack of firmness in the soil tends to produce loose, unhearted crops, and therefore the longer the interval between ploughing and planting the better. As soon as the previous crop has been cleared, the land should be deeply ploughed, sub-soiled, rolled and worked to a fine tilth. When this tilth has been obtained the Cambridge roll should be applied. If, however, firmness is not obtained with the first rolling, the land should be harrowed and rolled again.

When ley ground is used, the herbage should be tightly grazed and the surface scarified or disc-harrowed before ploughing. This ensures a thorough breaking down of the turf. When the turf is only turned under in a solid furrow, puffiness tends to occur as rotting takes place, which results in indifferent crops. If a green manure crop has been ploughed into light land, frequent rollings before planting are essential.

During dry periods in summer, when the land is hard and baked after the previous crop, it should first be thoroughly disced to a depth of 3 to 4 in. before ploughing and sub-soiling. A ring roll should follow the plough, and a single-tooth harrow should be attached to the roll, so that a loose tilth is again left on the surface. Other cultivations often prove necessary, but in order to ensure

firmness the land must be rolled with a Cambridge roll as the final operation. Land treated in this way will hold the requisite amount of moisture to permit immediate planting without waiting for rain.

Base Dressings

Cabbage crops have to be grown rapidly and fertile soil conditions and liberal manurial treatment are necessary for high yields of good quality cabbage. A plentiful supply of organic matter is necessary on the less fertile soils, enabling the plants to grow well and withstand periods of unfavourable weather without undue check to growth. Although stable and farmyard manures form the best source of organic matter, they are often not available, and composted straw, sewage sludge or shoddy may be used instead. Stable manure or other bulky material should be ploughed in well in advance of planting or the land will not be sufficiently firm.

As a rule when good ley ground is ploughed sufficiently early to permit decomposition of the turf, dung is rarely needed, but in some districts with high rainfall it is advisable to reduce nitrogen in any dressings of fertilizers subsequently applied. With short leys a dressing of dung at the rate of 15 tons per acre can be applied with advantage before ploughing. A similar dressing of dung may be given where the crop follows roots, unless the roots have been folded off with sheep. If the land is in poor heart, at least 30 tons per acre of rotted dung should be applied and more can be given with benefit on light soils.

The foregoing manures will not always provide sufficient nitrogen, phosphate or potash for the various crops, and further additions of manures or fertilizers should be given in accordance with the requirements of the particular crop.

Top Dressings

Quick-acting nitrogenous fertilizers, such as nitrate of soda, Nitro-Chalk, Nitra-Shell, potash nitrate or sulphate of ammonia, can be given to the crop as top dressings. The use of these fertilizers needs experience, because, unless the correct amount is applied at the right stage of growth, the crops may suffer. As their effect is not continuous, however, it is better to apply small doses, say, about 2 cwt per acre, at intervals during the growing season, according to need. All top dressings should be hoed in after application so that they may be incorporated with the soil.

Soot of good quality is also used as a top dressing for cabbage plants in some districts as a source of nitrogen.

The various suggestions regarding dressings made here and in the sections dealing with particular crops must be accepted only as general guides to the requirements of the various cabbage crops. It should be emphasized that the correct rate of application will depend on soil conditions and the level of fertility from previous cropping and manuring. The right treatment should be determined in the light of previous experience of the field concerned and by observation of the crop's response to any dressing applied.

Seed Sowing and Plant Raising

Methods

There are two methods of raising cabbage crops: (*a*) sowing direct in the field where the crop will mature and afterwards thinning out ("chopping out");

(*b*) raising plants in a seed-bed in the open or in frames and afterwards transplanting the seedlings in the field where the crop will mature.

Both methods have their advantages and disadvantages, not all of which apply to every part of the country. Sowing direct and chopping out requires more seed per acre but less labour than the transplanted crop. It is easier to control weeds on the seedbed than with the crop drilled direct in the field. With spring cabbage crops particularly, drilling takes place at a time of year when the growth of weed seedlings can be very troublesome, and it is therefore essential that clean land only should be chosen for direct drilling. With spring cabbage, drilled crops are often said to withstand a hard winter better than plants unduly checked by transplanting.

Probably the main advantage of drilling is as a means of overcoming the difficulty of droughty periods in summer, when the check from transplanting is severe. The method is, therefore, particularly applicable to the drier parts of the country. On the other hand it is often easier to find a small piece of land for sowing a seedbed than to reserve larger fields for drilling the crop direct; these may still be occupied by the previous crop. Much must depend on the crop succession practised on the farm concerned.

Some growers of good seed stocks regularly raise more plants than they need for themselves and sell the surplus, for which there is a considerable trade, since not all growers raise their own plants. Farmers frequently have no land available at the right time for a seedbed, and are therefore obliged to buy in plants.

If rabbits or hares are present in any number it is essential to fence the field with wire netting (see page 24).

Seed Rates

As a general guide, the quantity of cabbage seed required for drilling an acre of land direct is 2½ to 4 lb, according to the spacing of the rows, which may be from 12 to 24 in. or more apart. The seed is sown just thickly enough to give a "stand" of plants when chopped out.

When plants are raised in a seedbed for transplanting, 6 to 8 lb of seed are sufficient to sow an acre, according to the distance between the rows. An acre of seedbed should produce sufficient plants to plant up 8 acres of land at 15 in. × 15 in. spacing (see Appendix II).

It may be advisable to protect the seedlings against early attacks of cabbage root fly and other pests. This can be done by treating the seed before sowing with a gamma-BHC seed dressing. Further details of this and other methods of pest control are given on pp. 16 and 20–24.

Sowing Periods

There are four main seasons for sowing in seedbeds in the open, the exact dates depending upon climate and locality:

(*a*) Summer and autumn cabbage is sown in early March to late April, for transplanting in April to early June. In addition, early summer cabbage for cutting in June may be sown under glass in January to February for planting outside as soon as weather conditions are fit.

(*b*) Winter cabbage is sown in seedbeds from early May to the end of the month for transplanting from end of June to mid-July, or is drilled direct and chopped out.

(*c*) Early savoys are sown from the end of April to early May for planting out from early to mid-June; mid-season varieties are sown mid-May and planted out in early July; late savoys, sown from early May to end of the month, are planted out in mid-July.

(*d*) Spring cabbage and greens are sown from July to August, for transplanting in September to late October, or direct sowing to stand.

When the seed is drilled where the plants are to mature and the seedlings are chopped out, the sowing dates may be approximately two to three weeks later than for a seedbed.

Seedbed Preparation and Sowing

As the aim is to produce sturdy uniform plants rather than large or leggy ones, the seedbed should not be heavily manured. A dressing of lime at the rate of 10 cwt per acre should be thoroughly worked into the top soil before sowing, unless the soil is alkaline. If the land is known to be deficient in phosphate, a dressing of superphosphate, at the rate of 4 cwt per acre, should be given.

Thorough cultivation is necessary to obtain a firm but well moved bed with adequate drainage. The land should be ploughed and sub-soiled well in advance, and at sowing time the surface should be worked down to a fine tilth and well consolidated by rolling.

Soil condition should be a guiding factor in deciding when to sow. When a seedbed is not in really good tilth, it is better to delay a little rather than follow an arbitrary date. Nevertheless, if seed is sown too early or too late, the plants may be either too forward or too young and tender, and may suffer from severe weather or bolt after transplanting.

Seed is sown thinly $\frac{3}{4}$ in. deep in drills from 12 to 18 in. apart. Closer-set drills are difficult to hoe except with skilled hand labour and the wider spacing can be used if mechanical cultivations are to be done. To guard against early attacks of flea beetles the seed should be dressed with gamma-BHC seed dressing according to the maker's instructions. The sowing of batches at intervals of a few days or a week or so helps to spread the work of transplanting when available labour is limited, and ensures that plants are in the right condition, however extended the period of planting.

After sowing, rolling may be advisable, especially under dry conditions, to assist early germination and to break down small clods which provide cover for flea beetles. All seedbeds should be kept free from weeds. At pulling time a friable condition of the soil is necessary so that the plants may be drawn easily and freely without loss of root.

Planting Out

A large block of cabbages planted to mature at the same time involves much labour in carrying produce to the headlands, and heavy expense will be incurred unless adequate roadways are left for carting the packages from the field. These driving roads should be placed at convenient intervals and should be about 8 ft wide; in very large fields cross-roads may be necessary. The roads should be planted with some more quickly maturing crop; for instance, in fields of spring cabbage, greens could be cleared in the roads before the maincrop has hearted.

The plant distances having been decided upon, a marker is drawn across

the field in both directions, the points of intersection marking the sites of the plants. Whatever distances are adopted, the layout should allow for hoeing both ways whenever practicable.

Short, even-sized, sturdy plants should always be chosen. "Blind" plants, which show no growing point, and "bolters" which are long, drawn-out weakly plants, sometimes with purplish bronzing or other coloration of the lower leaves, should be discarded when selecting plants from the seedbed. When mechanical planters are used, it is essential that all the plants should be even in size, with good straight stems. Trimming of the leaves or tap root may sometimes be necessary to enable the machine to handle rather large plants.

Planting should be uniform in depth, the surface soil being almost on a level with the point where the first two leaf-stalks join the stem, and the hole deep enough to take the full length of the tap root. Care should be taken to put pressure on the root of the plant in the correct manner or the plant may hang by the collar with the roots dangling in the dibber hole. Under dry planting conditions the roots should not be allowed to dry out between the time of pulling from the seedbed and planting out in their final stations. The top dust should be knocked aside with the dibber before the hole is made, to prevent dry soil falling back into the hole while planting. Watering-in may be necessary with summer plantings during very dry periods.

Machine Planting

Good planting by hand is an expert job, and, in these days of shortage of trained labour, machine planting should be adopted whenever possible. With mechanical planting, the roots of the plants are not exposed so much to the wind and sun as when hand planted; also the roots are more evenly spread in the ground and pressure is applied to the plant at the right place.

Mechanical planters are now on the market which can plant cabbage at the rate of 4,000 to 6,000 per hour, but it is essential that they should be handled by an expert tractor driver who can adjust his furrow for planting at any required distance. In order that large areas may be planted out quickly, advantage should be taken of showers, as firm soil is essential if the best results are to be obtained (see also p. 17).

Cultivations and Irrigation

When plants have been well grown and carefully planted out under good conditions few gaps require replanting. Experience shows that it is desirable to do any necessary mending at the earliest possible date which should certainly not be more than a fortnight after finishing planting out, as postponement usually leads to patchy crops.

After planting, every effort should be made to control weeds and to aerate the soil by regular horse or hand hoeing down the rows and, where possible, across them. If weeds make rapid growth, several hoeings may be necessary.

To maintain steady growth, fertilizers must be given in the form of top dressings, which form part of the cultivations after planting.

Growers have found from practical experience that, although moisture can be conserved by careful soil management, the advantages of an irrigation plant are obvious*. If one is available, it may be used at planting time during periods

*Bulletin No. 138 Irrigation. Obtainable from H.M. Stationery Office or through any bookseller. Price 4*s.* 6*d.* (4*s.* 11*d. by post*).

of drought, water generally being applied before ploughing or before cultivations in preparation for planting. Watering after ploughing may encourage club root, while the chief objection to irrigating after cultivation and before planting is that under some circumstances the land may remain in a cold and poor condition for working.

When irrigation is carried out before ploughing, the land should be cleared of all weeds and waste material from the previous crop, and the equivalent of one inch of rain applied over a period of 8 hours. As soon as possible after irrigation, the surface of the soil should be moved. Ploughing and cultivation should take place within 24 hours of irrigating, or as soon as the ground is dry enough to justify a start. The land should be ploughed, sub-soiled and rolled, then harrowed. Planting should take place as quickly as possible and mechanical tools used to create a tilth after planting.

When the soil already contains sufficient moisture to firm plants inserted by a machine, watering after planting proves very satisfactory. In this case the equivalent of one inch of rain should be spread over three waterings, each given at intervals of three days. After the final watering, mechanical tools should be used to create a dust tilth. If the land is left in a hard condition and becomes baked and poorly aerated, trouble is bound to arise.

During periods of drought, plants often suffer from shortage of nitrogen, and for this reason it is advisable when irrigating to add nitrogen to the water in the form of a soluble nitrate or sulphate of ammonia or, if this is not possible, to give a dressing of 1 cwt per acre nitrate of lime or Chilean potash nitrate before watering.

Marketing

The demand for cabbages and savoys for human consumption in this country is met by home produced supplies. With the exception of the very early crops of spring cabbage, which are specially grown in favoured districts with a mild winter climate, cabbages and savoys are grown fairly generally throughout the country.

In addition to supplies in the fresh vegetable market, there are also possible outlets to manufacturers, such as the production of red cabbage for pickling. In recent years the development of the preservation of vegetables by dehydration and by the quick-freeze industry utilizes Brussels sprouts and calabrese. It is also possible that the prevention of deterioration of perishable green vegetables by chilling or refrigeration may be developed, particularly as a means of levelling out peaks of supply to markets.

PRODUCTION OF PRINCIPAL CABBAGE CROPS

Spring Cabbage and Spring Greens

Spring cabbage frequently follows peas, beans or second early potatoes; in some districts spring greens are planted after later lifted crops, such as maincrop potatoes and onions. Spring greens are frequently followed by maincrop carrots or beet, sown in mid-June or early July. On some farms and market gardens spring cabbage is regarded as a "catch crop" which, in the event of glutted markets, is fed to cattle, folded to sheep or ploughed in.

As land for spring cabbage must not lie wet during the winter months and must be workable not later than February, "early" land gives the best results.

If there is the slightest doubt as to the drainage of the land, the crop can be planted on ridges or can be lightly ridged in November to ensure that surplus water can drain away from the crowns of the plants. This banking also prevents winter gale damage besides giving earlier maturity by improving the drainage.

For raising plants in a seedbed, seed is drilled ¾ in. deep in rows 12 to 18 in. apart, from late July to early August, according to the district, or a fortnight later if sown direct for chopping out. Usual spacings are 12 × 9 in. for spring greens drilled and chopped out if the work is done by hand, 15 × 12 in. for transplanted spring greens, and up to 24 × 18 in. for hearting spring cabbage. With mechanical cultivations the row and plant spacings are arranged to suit the implements used.

Some growers drill the seed for spring cabbage more thickly than normal (6 lb per acre) in 12 to 18 in. rows and pull many of the plants for transplanting elsewhere. After pulling, the seedbed is left with plants set out at 9 in. apart in the row. Care is needed to ensure that workers do not tread on the remaining plants and that seedlings do not become leggy through remaining too long in an overcrowded condition.

Cabbage plants heat badly during rail transit and are consequently not satisfactory for planting out. When growers have to purchase plants because they are without land free for plant production in July it is, therefore, best to obtain them locally if possible.

The land for spring greens or cabbage should be ploughed as soon as possible after the previous crop has been cleared. Subsoiling is best carried out for the previous crop (see page 2). After ploughing, the surface should not be worked down too finely, as cabbage stands the winter better with a rough soil surface.

Transplanting is carried out from mid-September to late October, according to district, but all planting must be completed by about 25th October, or the plants will not be sufficiently rooted to withstand the winter. Ridging, earthing up, or planting with a "rucker" may be desirable (see page 29). One hoeing should be given before December. Spring cultivations commence from mid-February, and are coupled with top dressings of quick-acting fertilizers.

Excess nitrogen in the autumn usually results in soft growth and failure to stand the winter, especially if cold weather comes suddenly after a mild, late autumn. Hoof-and-horn and other forms of organic nitrogen are often preferred on soils of moderate fertility, because of the steady release of nitrogen in an available form, the release increasing in spring when the weather improves and the plants start into active growth. In addition top dressings of a quick-acting nitrogenous fertilizer such as Nitro-Chalk or Nitra-Shell are usually required in early spring. Adequate dressings of potash should be given to promote winter hardiness.

Farmyard manure may or may not be used, but 6–10 cwt per acre of a 7 : 7 : 10½ compound fertilizer or its equivalent should be cultivated in during the final preparation for planting.

With the moderate autumn dressings of nitrogenous manures suggested above, there is little reason to fear a decrease in the winter hardiness of spring cabbage. Moreover, where plants have suffered severely from frost damage in exceptionally hard winters, the rate of recovery and the final yield may largely depend on adequate top dressings of nitrogen applied in early spring. Top dressing commences with the spring cultivations, and one or more top dressings

may be given as follows: 2–4 cwt per acre nitrate of soda, Nitro-Chalk, Nitra-Shell, or sulphate of ammonia, or 1 to 1½ cwt Chilean potash nitrate.

The response of spring cabbage or greens to manurial treatment, especially nitrogen, varies greatly with the locality, climate and season. Growers in the earliest coastal districts, using early selections, may be cutting from November to January, and since they hope to clear before the worst spells of winter frost and wind, the heaviest rates of manuring can be safely advised. Even then, a late winter top dressing of quick-acting nitrogen may be needed.

If the crop is being produced for spring hearting in March to June (according to the district) the application of nitrogen in the autumn should be at the lowest rates, and should be followed by top dressings in the spring.

Spring cabbages are marketed either in a semi-hearted condition as spring greens, when the dates of cutting are influenced by weather conditions and by the prices ruling at the time the crop has reached a suitable stage, or as hearted spring cabbage towards the middle of April. The fields should be gone over once or twice a week, and plants with firm hearts of a reasonable size cut and packed. The smaller hearted plants should be included with any portion of the crop to be marketed as greens, to which they will add weight and attractiveness.

Spring cabbages are usually sold by weight or by package, and must be firmly packed. Bags holding 30–40 lb are used in many parts of the country. Although light and easily packed and stacked, they are not the most suitable containers for tender produce such as spring cabbage, as there is danger of heating and damage in transit.

The most satisfactory method of marketing good quality cabbages or greens is to pack them in wooden containers. For example, growers in the Vale of Evesham favour the returnable wooden "pot" crate. The returnable bushel box, holding 12–21 heads, is the package most used by growers in the Home Counties for marketing spring cabbage in the London area. Broccoli crates* may be used; these hold 40 lb of greens or 24–36 heads of cabbage packed butts outwards like winter cauliflower (broccoli).

Summer and Autumn Cabbage

This crop is cut from June to October, or later. There is usually a market in June or July for spring-sown cabbage of the 'Primo' type. In August, the demand for cabbages, both pointed- and round-headed types, revives and continues until autumn with the arrival of Brussels sprouts on the market.

Land for this crop should be ploughed and sub-soiled in the late autumn, and left to settle down and weather. In some districts, it is possible to take late summer or autumn cabbage after a winter crop, such as leeks, spring onions, bunched carrots, lettuce or spinach.

Glass-raised plants of 'Primo', 'May Express', 'Pride of the Market' or 'June Giant', sown in January or February for cutting in June, can be a useful crop in the south, and are especially valuable when spring cabbage has wintered badly. The earliest maturing plants are obtained by germinating seed at a night temperature of 45–50°F in early February. The seedlings are transplanted into boxes about 12 days later using J.I.P.1 as a compost. The plants

* The internal dimensions of the B.S.I. Standard collapsible crate are $22 \times 14\frac{3}{8} \times 13\frac{3}{16}$ in. (see B.S.I. 2034 (1953), obtainable from the British Standards Institution, 2 Park Street, London, W.1, price 2*s.* 6*d.*).

are spaced out 40 to a Dutch tomato box, that is, about 2 in. each way, and after pricking off are placed in a temperature of 55–60°F for 2–3 weeks. Thereafter the young plants are stood in cold frames, ventilated when possible, and usually uncovered at the end of March in readiness for planting out from 5th April onwards. Planting is best done with a trowel, the extra cost of this work being fully met by a gain in earliness as compared with pulled plants. A more usual practice is to sow the seed broadcast or in rows 6 in. apart in cold frames or glasshouse beds. No ventilation is given until the seedlings are breaking ground, when air is gradually admitted. After hardening, the seedlings are finally planted outside in late March or April, in rows 18 in. × 12 in.

In the south the first sowing for a seedbed, or for drilling direct and chopping out, is made in early March and is followed by a second sowing at the end of March or early April. Spacings are usually 14–18 in. × 20–24 in. according to the size of the variety. In the northern counties seed is sown from March to early May, the earliest sowings being in frames, and seedlings are planted out from June to late July, the spacings being 18–24 in. × 24–27 in.

These crops have to be grown rapidly to be successful, and generous manuring is required, farmyard manure being desirable on poor soils. For medium fertile soils, 15 tons farmyard manure and a base dressing of 4 cwt sulphate of ammonia or Nitro-Chalk, 3 cwt superphosphate, and 2 cwt muriate of potash may be given for summer crops. On rich soils 8 cwt of a 7 : 7 : 10½ compound fertilizer or its equivalent should suffice. For the earliest crops of 'Primo' which require especially rich soil conditions, dressings of hoof-and-horn or other forms of organic nitrogen are often given; for example, 5 cwt hoof-and-horn, 2 cwt superphosphate, and 1 cwt muriate of potash. Nitrogenous top dressing may sometimes be required in addition for summer crops.

As summer and autumn cabbages are less subject to damage than spring cabbage, they can be packed in bags, coir mats or nets. The cabbage bag commonly used holds about 20 large cabbages, or about 24–30 smaller ones, the contents weighing about 60–70 lb. Wooden boxes or crates are the best type of container for transport of this produce both at short range or to more distant markets.

Winter Cabbage

Although in recent years, there has been increased production of winter cabbage, there is still room for some hearted cabbage which will stand from Christmas to late March. The art of this late production consists in choosing the right variety and sowing it at the correct time. Seed is sown from end of April to mid-May according to district and seedlings are ready for planting from early June to mid-July. In the south it should be completed not later than mid-July. When the crop is to be chopped out, in the south sowing can be delayed until mid-May or the end of the first week of June. Spacing should not be less than 24 in. × 18 in. and this distance should be increased to 24 in. square on some soils.

As the right time for transplanting very often coincides with dry periods, which check growth and prevent hearting, winter cabbage is rather more difficult to produce successfully than the other cabbage crops. Irrigation makes all the difference in keeping to the time-table, but failing that, drilling and chopping out may prove the best alternative in very droughty periods. If drilled too early, however, the crop will turn in too soon.

With summer plantings in dry weather, as soon as the plants have recovered

and the roots established contact with the soil moisture a dust tilth should be re-established, using either a horse hoe or some mechanical row-cropping outfit.

Less nitrogen and more potash are required for the winter crops because of the necessity of producing a harder type of growth more resistant to frost injury. On ordinary farm land, 2 cwt sulphate of ammonia, Nitra-Shell or Nitro-Chalk, 3 cwt superphosphate, and 2 cwt muriate of potash, or 5–8 cwt of a 7 : 7 : 10½ compound fertilizer or its equivalent should be given as a base dressing, but top dressing is not advised for this crop.

Cultivation, cutting and marketing methods are similar to those for summer cabbage (see above).

Savoys

Being in season from September to March and resistant to frost, savoys are especially grown in the north of England, where very large areas are the mainstay of the vegetable markets during the winter months. In the northern industrial areas market gardeners favour the growing of early savoy, so that the labour supply can be dovetailed in with that required for the forced rhubarb industry, and also to avoid the soot deposits which contaminate later crops. As this tends to glut the northern markets before Christmas, growers outside these areas might consider whether it would not pay better to cater for the late trade with late-hearting savoy and cabbage which undoubtedly exists in these districts, and reduce the acreage of early cabbage and savoy. For a different reason the southern markets may be glutted before Christmas, because late savoy and cabbage are sometimes sown too early, and the crops turn in before the market is ready for the produce.

In the south, a savoy crop is usually taken following a crop cleared in early summer, such as early peas or potatoes, or late-cleared leeks. In the north, as the savoy occupies the land for a longer period, it is frequently impossible to take another crop before it. Consequently, the land is prepared for savoys in the previous autumn or early winter, after clearing a crop of oats or maincrop potatoes.

Early savoys are sown from the end of April to early May and are planted out early to mid-June; mid-season varieties such as 'Ormskirk Medium' are sown at mid-May for planting out early in July; while late season savoys are sown from early May to the end of the month and are planted out in mid-July. Manuring is the same as for winter cabbage.

Cutting and marketing begin in September with the early varieties, finishing with the latest varieties in March. Heads which are hard, dark green and weighing 3 to 4 lb are in chief demand. In Lancashire, savoys are usually delivered to market loose on lorries. The returnable cabbage box and coir mat, holding about 20 heads or about 60 to 70 lb of savoys, are popular in the Home Counties.

Red Cabbage

Red cabbage is grown by market gardeners in Lancashire, Northumberland and Yorkshire, mainly in the East Riding, and also in Worcestershire, Middlesex, Kent and Essex. For the most part red cabbage is sold in small quantities in the markets and shops for home pickling, but a large proportion of the crop is grown on contract for the pickling factories.

Few English varieties are readily acceptable to the pickle manufacturers,

owing to their poor colour after pickling. If seed can be obtained the Dutch variety 'Langedyke No. 2' is very satisfactory, but it is not widely offered for sale in England. In so far as seed supplies allow, this variety is likely to be the first choice for contract growing. If seed of the Dutch variety is unobtainable, 'Niggerhead' has been found to crop well, although it is less acceptable to the picklers.

The following is an outline of the cultural methods practised in the East Riding of Yorkshire. Seed is sown in both autumn and spring. Autumn sowings are made in frames under Dutch lights to provide plants for the early plantings in late April and early May. Sowings in frames and in the open are also made from mid-February to late March, and the plants are planted out from mid-May to mid-June.

Growers usually make more than one planting in order to have supplies coming along in succession for intake by the factory. Thus the first planting may be in late April or early May for cutting in mid-August; second planting mid-May for cutting in late August and early September; and often a third planting in early June for the last cutting in early October.

Brussels Sprouts

Brussels sprouts can be successfully cultivated in almost all parts of Great Britain and on a great range of soils. There is a continuous demand for this vegetable during the autumn and winter months at prices which show little fluctuation in normal times.

The public favour solid sprouts of medium size (1¼ to 1½ in. diameter). Seed of types and varieties specially suitable for most districts are available in those localities, or may be obtained from a reliable firm or from local growers.

Varieties

The characteristics which make a good commercial variety are by no means fixed, and varieties of sprouts require constant and careful selection each year to keep them true to name. If the basis of selection is varied in any way it does not take long for a variety to change its character. Thus selection when conducted by different seedsmen tends to result in the development of several strains of the same variety.

It is for this reason that different stocks of the same variety are sometimes appreciably different from each other. The grower should ensure that seed is obtained from only the most reliable sources and, whenever possible, with some guarantee that the seed is a true stock of the variety named. It is important to grow only good stocks, as a bad one produces "blowers" or open sprouts. Many growers successfully maintain their own stock by selecting plants with the desired characteristics each year.

The varieties listed below have been found to be among the best available at the moment, though there are undoubtedly others which have claims to consideration for specific purposes or areas. They are given in season of cropping, but it should be pointed out that this characteristic is not fixed, and there is

considerable overlapping even between early and late varieties. As further trials are made some varieties may be replaced and others added to the list.

Medium coloured sprouts

Early to Mid-season: Cambridge No. 1*, Climax, Ambassador, Triumph.
Mid-season to late: Irish Elegance*, Evesham Special.

'Irish Elegance' can be expected to give good yields of smooth clean sprouts only when grown under conditions of high fertility. Under average to poor conditions it grows and crops much less well, and the more vigorous but less smooth sprouted variety 'Evesham Special' would be preferred.

Dark coloured sprouts

Mid-season to late: Ashwell's, Bintree, Evergreen, King Pin, Market Rearguard.

These varieties could be expected to give somewhat lower total yields than the earlier maturing, paler coloured varieties though their crops late in the season should be higher. All are vigorous growers.

There are no dark sprouted early maturing varieties.

Quick Freezing

Cambridge Special*, Freezer, Irish Glacier*.

'Irish Glacier' is rather later maturing and is generally rather lower yielding but has its sprouts more widely spaced on the stem.

The above varieties can be recommended for use in all parts of the country except Cornwall where ring spot (*Mycosphaerella brassicicola*) makes the growing of any variety difficult. No fully resistant variety has yet been found, but there is an indication that the dark sprouted varieties are more resistant than the paler types.

For northern districts other varieties such as 'Cluseed', 'King of the Lates', 'Latest and Best', may be added to the list of mid-season to late medium coloured varieties. Such varieties have, however, been found to be generally less suitable for cultivation in southern England.

Soils and Manuring

Deep loams and retentive soils, but with good drainage, generally give the best results, although with correct management some lighter soils will produce good crops. If solid, tight sprouts of high market value are to be obtained, a firm soil is essential. Loose soils give rise to rosettes of leaves instead of solid sprouts. The lime content of the soil must also be adequate.

Soil acidity encourages club root, and if the soil is acid, a dressing of ground limestone or its equivalent should be given before taking the crop, and, if necessary, a further dressing applied after the crop is finished, in accordance with the lime requirements of the soil, as shown by soil analysis.

Growers should consult the National Agricultural Advisory Service for advice on soil treatment, both in respect of lime and fertilizers.

Land Preparation

Brussels sprouts will fit into many farm rotations and may be planted on broken-up ley, or follow wheat or maincrop potatoes.

* Certified seed of these varieties is available.

The proper preparation of the soil, and the availability of a supply of nutrients on which the plant can draw gradually are important points. The ploughing under of pastures and short term leys several months ahead of the actual planting is most important. It is also desirable that old pastures should be thoroughly disced in both directions before the final ploughing, so that the soil may be well consolidated before the planting season. Less damage from wireworms is experienced in well-firmed soils.

Decay is hastened by giving the old turf of rough pasture land a light dressing of sulphate of ammonia (2–3 cwt per acre) before the turf is ploughed under.

Deep ploughing is essential, including the breaking up of the bottom of the furrow or subsoiling by means of a suitable subsoiler or similar implement. In soils deeply cultivated, better rooting is obtained, and plants do not suffer so severely during periods of drought as those grown on shallow worked land where there is a pan. These operations should, if possible, be completed before Christmas or may be done for the previous crop.

Ordinary farm land which has carried several white crops (cereals) may have to be given up to 30 tons of farmyard manure per acre before ploughing.

As the planting season approaches, the land, if it is at all loose, should be consolidated by rolling when the surface is dry (i.e., when the soil is no longer wet enough to stick to the workers' boots). This should be followed by light harrowings to keep down weed growth and provide a loose surface condition. Gradually available supplies of plant nutrients are necessary, and are usually provided by a base dressing before planting, and top dressings to follow.

Base Dressing

The base dressing should supply all the phosphate and potash needs of the crop. A concentrated granular compound fertilizer is commonly used, which should have a high potash ratio. If farmyard manure is available, it may be used, but should not be overdone. Loose or puffy soils tend to produce "blowers". The fertilizer dressing should be well harrowed in a week or two before planting.

Potash is important for the production of firm bright sprouts and on average land 3 cwt per acre muriate of potash (60 per cent) is needed. If a compound fertilizer is used, one with a high potash ratio should be chosen; for instance, a compound containing 18 per cent K_2O should be used at 10 cwt per acre.

Phosphate is important in the early stages of growth, and 3–4 cwt per acre superphosphate is suggested. If a compound fertilizer is used at 10 cwt per acre it should contain 7 per cent P_2O_5 to give an equivalent dressing.

Nitrogen is needed in generous amounts, but an excess should not be given at one time. Usually the base dressing contains one-third of the crop's needs, and the remaining two-thirds are put on as top dressings. The base dressing could have 3 cwt per acre sulphate of ammonia, Nitro-Chalk or Nitra-Shell, although heavier amounts are often used in the drier eastern parts of the country. Shoddy may be ploughed in in the autumn before planting at about 2 tons per acre and if it contains 6–8 per cent nitrogen no further nitrogen should be needed in either the base dressing or top dressings.

The above suggestions are for average land, and amounts should be adjusted according to previous experience or soil analysis.

Top Dressings

Two top dressings of nitrogen are usually given, unless a steady acting source of nitrogen such as shoddy was given before planting. Sulphate of ammonia, Nitro-Chalk or Nitra-Shell may be used. The dressings are usually given in early July and late August, the amount varying with the fertility of the soil and the part of the country, but 3–4 cwt per acre are usually given at each application. If a granular fertilizer is used, it can be spread with a distributor for the first dressing, while the plants are small.

Seed Sowing and Plant Raising

The seed may be sown either in (*a*) autumn or spring in the open, or (*b*) late winter in frames.

(*a*) Autumn sowing is not now widely practised. Sowings in sheltered seed beds can be made during August or early September. It is preferable to make sowings on two different dates so that selections of the most suitable plants can be made for transplanting. Six lb of seed will be required for an acre of seedbed, which will plant 10 acres. The plants from these sowings should be ready for setting out during late February and March.

(*b*) The sowings of the main crop should be made in open land during late February and March, according to locality. Six lb of seed are sufficient to sow an acre of seedbed, and one acre of seedbed will plant 16 to 20 acres.

The seed should be sown thinly in drills 9 to 18 in. apart, the date of sowing varying in different districts according to soil and climatic conditions (see pages 29–32). Drilling is preferable to broadcasting as the plants seem to benefit from hoeing.

(*c*) Late winter sowings in frames are made from early January to February, according to district. When using standard 6 × 4 ft frames, 4 oz of seed will be required for approximately 20 lights. The seed should be sown thinly, and if grown on the lines indicated, healthy sturdy plants should be produced for planting out in April. The frames should be on a gentle slope, the land being thoroughly prepared, and a light dressing of bone phosphate may be applied. The seed should be sown broadcast thinly and covered with about one-eighth of an inch of soil; this can be accomplished by carefully sieving soil over the seed. Holding it outside the frame, the sieve should be half-filled with soil and then gently rotated around the light until the seed is well covered. The soil should be sufficiently moist to make any further watering unnecessary. After sowing, the lights should be closed down. As soon as the seed is through, the lights should be taken off during dry periods but replaced at night. Air ventilation should be arranged by lifting alternate lights back and front. The plants should be protected during heavy rains or severe weather, though a sufficient gap should be left for ventilation. If the plants become frozen during the night they must be given full ventilation both back and front at dawn, or given light shade during thawing out, or they may be destroyed. Later in the season, as climatic conditions permit, the lights can be removed. These plants should be put out in their permanent positions as early as possible and before "legginess" develops.

Seedbed Preparation

The first consideration is to produce a hardy and sturdy plant. Succulent plants are more subject to disease and to damage at planting time.

Land which has not carried a brassica crop during the previous 12 months should be chosen. The soil should be thoroughly cultivated but not made too fertile. A dressing of superphosphate with potash should be given to the seedling in its early stage. A dressing per acre of 2 cwt superphosphate and 1½ cwt sulphate of muriate of potash is recommended; these fertilizers should be applied about a month before seed sowing.

Lime should be added to the seedbed in accordance with the requirements of the soil. The soil for the seedbed should be worked continuously to within a few days of seed sowing, as these pre-sowing cultivations reduce pests and destroy weeds. Consolidate by rolling before sowing, as slow growth is often experienced in loose soils. This rolling also reduces the small clods of soil which provide cover for flea beetles. In all cases cultivate and hoe before the weeds appear.

Pest Control in the Seedbed

Where flea beetles, stem weevil, cabbage root fly or wireworms are troublesome a gamma-BHC seed dressing gives effective protection to the seedlings at low cost. The seed should be dressed as near sowing time as possible and a sowing rate of 10 lb of seed per acre should not be exceeded, in order to minimize the risk of the BHC damaging the seedlings. The rate of application is 1 oz per lb of seed with a dressing containing 75 per cent gamma-BHC.

After sowing (*a*) to control aphids spray with TEPP, schradan or demeton methyl.

(*b*) to control cabbage root fly (if the seed has not been treated before sowing) first, dust the rows of seed before covering with ½ oz of 1¼ per cent aldrin dust per 10 yd of row; then, in warm weather after mid-April or when the plants are in the second rough leaf stage, whichever is later, dust or water insecticide on to the rows at the following rates:

1¼ per cent aldrin dust at 1 lb per 60 yd of row
or 0·06 per cent aldrin emulsion at 1 gal per 40 yd of row
or 0·03 per cent dieldrin at 1 gal per 40 yd of row.

These treatments will prevent any further damage by flea beetles and may give some control of other pests (see also pages 20–24).

Planting Out

The over-wintered plants in the seedbeds or seed rows may be transferred to their permanent quarters during late February or March according to district, frame raised plants during April, and the sowings for the main crop during May and June. "Mending" due to "bolters" may be necessary with the over-wintered plants.

The plants are set out at 3 ft square (i.e., at 4,840 plants per acre) though in some areas it is preferred to put rows at 3 ft 6 in. apart. The smaller growing varieties grown for canning or quick freezing do not require so much room and may be planted at, say, 24 × 24 in. with advantage. Planting methods vary, but

[*Photo: Fox Photos, Ltd.*

Row-crop cultivation of cabbage with small two-wheeled type of tractor

[*Photo: National Institute of Agricultural Engineering*

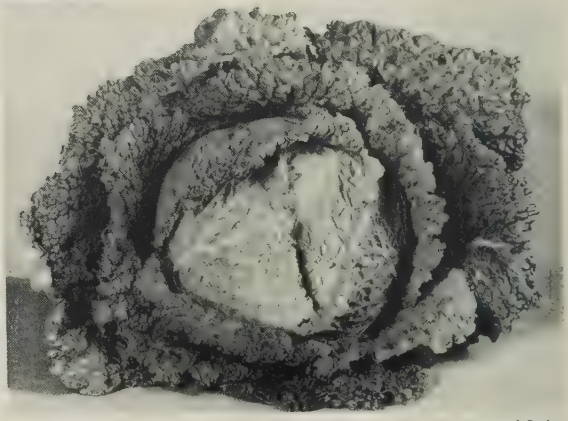
A larger type of row-crop cultivator

PLATE I

Cabbage: Winnigstadt (pointed-head type)

Cabbage: Primo (round-headed type)

Savoy: Green Curled



[*Photos : Royal Horticultural Society*

PLATE II

Brussels Sprouts: *Irish Elegance*

Brussels Sprouts: *Cambridge Special*

Brussels Sprouts: *Ashwell's*

PLATE III

[*Photo: Fox Photos, Ltd.*

Irrigation of summer cabbage. Note fine mist-like spray, permanent mains (in background) and portable pipes

in most areas growers mark out their fields in both directions. Seedlings can be planted by hand or machine.

In dry weather plants may be watered, but the value is lost in very hot weather unless dry soil is pulled over the watered surface, or the latter broken by hoeing.

It is important that the plants should be carefully lifted or pulled from the seedbed, which should be watered if necessary. The roots should not be exposed to sun and wind, as this is the main reason for the failure of plants to grow away. The plants should be thoroughly inspected for aphis, club root, gall weevil, blindness, etc., and should not be too large, so that they do not receive a check at planting time. The selection and grading of the plants before commencing to plant out also pays for the little extra trouble.

Mechanical Planting

The use of mechanical planters has become more widespread with the development of single unit types, which can be attached singly or in multiples to a tractor toolbar, and machine planting is now practicable on both large and small areas. With all types it is advantageous to use a tractor which will pull smoothly at speeds down to ½ m.p.h.

Plants cannot readily be set out on the square when planted mechanically, due to irregular spacing between plants in the row as a result of wheel slip and other errors. Subsequent row crop cultivations therefore are usually only possible in one direction. The best results with planting machines are obtained on reasonably level fields, or where the slope is in one direction only and where pre-planting cultivations have been good. The final pre-planting operation should be rolling and not harrowing. With the requisite conditions fulfilled, machine planting often results in a better "take", and with an output per man three to four times greater than with hand planting (see also page 6).

Cultivations and Stump Clearing

Surface hoeings should follow planting and careful watch should be kept for aphid and caterpillar attacks.

The clearing and disposal of the stumps of the crop residues has always presented a problem. The stumps should not be ploughed under where level and firm seedbeds are required for a summer crop of vegetables but should be ploughed-out and carted off the land.

Where sprouts are grown as part of the farm rotation, it is common practice to put the crop residues back into the land and so help to maintain the organic status of the soil. There are several ways of doing this, such as cutting off the stumps at ground level and putting them into the plough furrow, or better still by using a rotavator several times over the field to chop the stumps up and work them into the surface of the soil before ploughing for the next crop.

Harvesting and Marketing

The earliest sprouts should be ready for picking in late August and early September. The picker should strip the leaves off the stem up to the point to which the sprouts will be picked. Some pickers strip the leaves beyond this point, but there is no proof of any advantage in this. Timely harvesting of the lower sprouts will assist the higher buds to swell. If these sprouts are not picked they may turn yellow and become slimy.

Although not a universal practice, it is customary in some areas to remove the top of the sprout plant after the second or third picking in order to encourage the remaining sprouts to swell. This is done in one of two ways: (*a*) only the small terminal bud is removed and discarded (cocking), or (*b*) the terminal bud is allowed to develop into a rosette of leaves and removed (topping), and these sprout tops are packed in bags and sent to market. In a period of shortage, a market can be found for blowers but they should be discarded from the best packs and sold separately.

Fields should be gone over regularly and frequently, for regular picking results in an even grade of sprouts and reduces the work of grading to a minimum. Where picking is delayed or the crop cleared in one or two pickings, a very mixed sample results. Grading in such cases is essential as there is a great variation in quality; more cleaning of the sprouts is also necessary. A slow-moving conveyor belt carrying the sprouts greatly facilitates the sorting and grading.

Sprouts are marketed in bags (28 lb), bushel boxes (28 lb), nets (20 lb), and lettuce crates (20 lb). Of these packages the net and lettuce crate are most in favour, the latter having largely replaced the sieve. The advantage of the net is that the contents can be seen by the buyer. For graded sprouts this is ideal, but small sprouts may fall through the meshes and the net is thus less suitable for a mixed sample.

The direct picking of sprouts into the market containers is undesirable, unless frequent pickings are made and grading for quality by selection can be carried out easily. Some growers "face off" packages, in the same way that apple packers make a "face" on an apple barrel, by placing the sprout stump downwards and head upwards. The contents throughout should be of the same quality as the face; topping does not pay.

With good average cultivation, the grower may expect a yield of about $3\frac{1}{2}$ tons per acre, but yields of up to 6 tons per acre are obtained by some growers.

Other Green Crops

Sprouting Broccoli

This differs from winter cauliflower (broccoli) through the flowers being borne on numerous shoots mixed with the leaves instead of being collected in one terminal head. Also, as sprouting broccoli is hardier than winter cauliflower, it is suitable for the eastern counties and is particularly useful when winter cauliflower has failed. There are two types, white (or green) and purple; the purple is more popular than the white, and is also usually more hardy.

Sprouting broccoli requires firm land with a fine tilth. The preparation of the land, cultivation and manuring are similar to those for Brussels sprouts.

Seedbed preparation is similar to that for Brussels sprouts (see page 16). Seed is sown at the rate of 8 lb per acre outside in April (1 acre of seedbed will plant 8–10 acres) and the plants are set out in June in their permanent positions at 30 in. each way.

The crops should be frequently hoed and cultivated while the plants are developing.

The shoots should be gathered when they are young and snap easily. They are usually marketed loose in wooden boxes or in bags.

Calabrese

This is an Italian green-sprouting broccoli producing tender green shoots, each with a small, tight, green cauliflower head. The shoots, harvested in late summer and autumn, are used almost exclusively for quick-freezing.

Seed should be sown in late April for planting 4–6 weeks later. Cutting commences in late July and can continue up to Christmas, with the peak period in August and September. Planting practices vary but a spacing of 2 ft from plant to plant with 3–3½ ft between the rows seems suitable under most conditions. Closer spacing has, however, been practised with success. When the plant is about 1 ft high the centre bud is nipped out and the crop is given a top dressing of nitrogen. This encourages the production of side growths required for cutting, which starts when the shoots are about 5 in. long and ½–¾ in. in diameter. Recently varieties have been developed which produce a larger central head and fewer side shoots. Most of the leaves are trimmed off before dispatch to the processer. The best quality shoots are produced in cool weather. A second top dressing of nitrogen is given after the first cutting to stimulate further shoot production. During the peak season the crop should be cut over two or three times per week. Under normal conditions yields of 2–4 tons per acre may be expected, but under irrigation coupled with well-judged applications of nitrogen, higher yields could be expected.

Kale (Borecole or "Curlies")

Though grown for market only to a limited extent, this is a reliable winter green crop, most varieties being uninjured by the hardest frost. There is, however, little demand for this vegetable except after a hard winter when other brassica crops have suffered damage.

Suitable varieties are 'Scotch Kale', 'Tall Green Curled' and 'Dwarf Green Curled'.

The preparation of the land, cultivation and manures are similar to those for spring greens.

The seedbed is prepared in the same way as for Brussels sprouts (see page 16). For 1 acre of seedbed 8 lb of seed are required, and this will be sufficient to plant up 8–10 acres. The seed is sown outside in March and April, two sowings being made to provide a succession in harvesting. Planting should be done in June or July, the plants being set out on land which has been cleared of early potatoes, between rows of second early potatoes or on any vacant space. About 24 in. apart each way is the usual spacing, though this may be increased with larger varieties.

Seed can also be sown direct in the field from which the crop will be taken, and cut out; from 2 to 3 lb per acre of seed is sufficient for this.

This crop is marketed in wooden crates, nets, or bags.

Pests and Diseases

Although the risk of losses from many pests and diseases can be reduced by cultural measures such as correct and timely cultivations, adequate manuring and destruction of weeds — in short, by good management and clean farming — direct remedial or preventive measures are frequently necessary. Only very brief notes on the chief methods of control of the more common pests and diseases of cauliflowers can be given here, but detailed information is available in the Ministry's leaflets.* It is essential that troubles should be correctly diagnosed and growers are advised to consult the National Agricultural Advisory Service in cases of doubt.

Cabbage Aphid (Advisory Leaflet No. 269)

The colonies of pale bluish aphids are founded on both heart and older leaves causing discoloured, stunted and distorted areas, which never recover completely. Infestations usually become noticeable in July, developing or dying out during August and September. During this period crops should be looked over at intervals for signs of a developing attack so that spraying can be done promptly. It may be noted here that with Brussels sprouts early injury alone has been shown frequently to cause a considerable drop in yield, indicating that more attention should be paid to infestations on recently transplanted crops.

The insecticides used for cabbage aphid control include the organophosphorus chemicals TEPP, demeton methyl and schradan. TEPP is relatively cheap, and is particularly useful for cleaning up crops near to harvest, because, whilst giving a good kill of aphids if thoroughly sprayed, the deposit on the plants breaks down within 48 hours into harmless substances.

Demeton methyl and schradan are systemic in action, i.e., they are absorbed by the plant, and both, but particularly schradan, are active for much longer than TEPP. They give an excellent control of aphids, but they must be used so that there is no poison risk to consumers. Schradan and demeton methyl should not be applied to any edible crop after 30th September. Not more than two applications should be made per season to sprouts, and one to cabbages. For both crops the shortest interval between the last application and harvesting should be three weeks.

Suitable formulations for high volume spraying are:

TEPP: 4 fl. oz of 40 per cent TEPP per 100 gal water with a wetter added according to the maker's directions.

Schradan: 0·2 per cent active ingredient.

Demeton methyl: 12–16 fl. oz of 50 per cent concentrate in 100 gal water with additional wetter.

Cabbage Caterpillars (Advisory Leaflet No. 69)

Cabbages and sprouts are hosts of the caterpillars of several butterflies and moths. In some years cabbage white butterflies are a serious pest; trouble can be expected when warnings of exceptional numbers of butterflies are given.

The caterpillars of cabbage whites, cabbage moth and others can be controlled by dusts and sprays containing either DDT, derris or lonchocarpus, or pyrethrum.

* See Appendix III.

Cabbage Root Fly (Advisory Leaflet No. 18)

The maggots of this fly cause serious damage to the roots of cabbage, broccoli and Brussels sprouts, and plants are liable to be attacked throughout the summer. The crop can be protected against attack from sowing time onwards by the methods summarized in this bulletin, and given in detail in the above advisory leaflet.

Seed and seedling treatments (see page 16) do not protect the crop after planting out, when the most damage is usually done. A good measure of protection, which also kills any maggots present, is given by dipping the transplants in aldrin or dieldrin liquids. This method is effective and costs much less than field treatment, but is liable to check the growth of the plants, particularly of broccoli, for which it is not recommended. After dipping the plants should be stood upright to drain — never laid horizontally, otherwise the liquid may run up the stem and burn the leaves or bud. They should be planted out within the next two hours.

Where club root is present calomel can be used as a dual purpose treatment (see under Club Root) although it does not compare well with the other insecticides mentioned for root fly control.

Transplanted crops can be protected by drenches and dusts containing aldrin or dieldrin, drenching being the more efficient, as well as supplying water to the plants. The method is to apply accurately to the base of each plant the equivalent of ½ pint of fluid containing 0·03 per cent dieldrin or 0·04 per cent aldrin, within about 4 days of planting out. Drenches do not seem to check plant growth, and any kind of spraying machine with trigger-controlled lances can be used; some designs have been adapted to treat several rows at a time.

Cutworms (Advisory Leaflet No. 225)

Cutworms sometimes do considerable damage to recently planted crops, especially of spring cabbage in autumn on ley ground. The plump dull-coloured caterpillars hide in the soil during the day, feeding at night on the stems and lower leaves of various plants, seedlings frequently being severed just above soil level.

Infestations of cutworms can be controlled by dusting the plant rows with 5 per cent DDT at ½ cwt per acre, and low volume sprays of DDT emulsion have controlled both cutworms and leatherjackets.

Flea Beetles (Advisory Leaflet No. 109)

These are most injurious to seedlings before and soon after emergence from the soil, although they also attack older plants.

On fine days a look out should be kept for small shiny beetles that jump, and for the damage, which consists of small round holes in the cotyledons and leaves. The use of sufficient fertilizer and a fine seedbed to facilitate regular germination and rapid growth is important. Excellent control can be obtained with DDT dust. One treatment with 2–2½ per cent dust at 40–50 lb per acre is usually sufficient when given 7–10 days after sowing, or just as seedlings begin to appear.

Turnip Gall Weevil (Advisory Leaflet No. 196)

This pest is found throughout Britain, but its economic importance is doubtful. The legless grubs live in roundish swellings at the base of the stems and tap

roots of various brassicas. The presence of the grub or its feeding cavity distinguishes the damage from that of club root disease.

Cabbage Stem Weevil*

The larvae of this pest may cause serious losses or stunting of young spring sown brassicas, especially in seedbeds. The weevils emerge from the soil in spring and summer, beginning in March. The females insert their eggs into the stems and leaf stalks of the seedling plants. The eggs develop in from 7–21 days according to temperature giving rise to the larval stage. The larvae tunnel at first under the skin and later in the pith of the stem, several developing in a single plant. Infested plants die sooner or later or grow weakly, and transplants from infested beds often make a poor uneven crop. Occasionally the larvae penetrate and kill the growing point, making the plant "blind". When fully fed the larvae pupate in the soil and the resultant weevils spend the rest of the summer and winter there, emerging in the spring.

Brassica seedbeds should be looked over carefully for the first signs of damage. At first the mines are visible externally as clear dark meandering lines in the stem and leaf stalks. Later the stems are frequently spongy and easily snap, this not usually being noticed until the transplants are being handled.

It has been shown that brassica seedbeds can be readily protected from attack by stem weevil. Successful methods are either to treat the seed before sowing at the rate of 1 oz per lb of seed with a dressing containing 75 per cent of gamma-BHC; or to apply a band of 0·02 per cent gamma-BHC suspension along the rows when the plants are in the second or third rough leaf stage. The seed dressing also gives good protection against early attacks of cabbage root fly and flea beetles (see page 16). In trials in the south-west, dieldrin applied at the rough leaf stage was more effective than BHC seed dressings.

Swede Midge†

Attacks wild and cultivated Cruciferae including swede, broccoli and cabbages. Females emerged from cocoons in the soil lay their eggs in the axils of the leaves, the heart leaves in the case of young plants. The larvae hatch in a few days and feed on the surface tissue causing distorted and stunted growth ("crumpled leaf") and sometimes even killing the central bud ("blindness"), the degree of injury depending on the stage of development of the plant when attacked and the number of larvae present. Normally three broods are produced per year, in July, August and September, but in Devon five generations have been observed from May to October.

Swede midge attacks, though widespread, do not often warrant insecticidal treatment, except perhaps in intensive brassica growing districts. The pest is a difficult one to control even with modern insecticides.

Cabbage Root Eelworm

This eelworm (*Heterodera cruciferae*) lives in and damages the roots of plants of the cabbage family, the females developing into cysts containing eggs in the same way as the potato root eelworm. As eggs in the cysts can remain alive for

* *Ceuthorhynchus quadridens* Panz.

† *Contarinia nasturtii* Kieffer.

some years it is very difficult to eliminate the pest once it has been allowed to build up. This has already happened in some brassica growing districts and there is evidence that in these areas the eelworm is causing stunting and loss of young plants where seeds have been sown on infested land. Seedbeds should not therefore be made frequently on the same ground, nor on land that has recently been cropped with brassicas.

Club Root (Advisory Leaflet No. 276)

This is most troublesome in sour or acid soils. Liming provides a permanent cure, but a long time must be allowed for its action, and guidance should always be sought from the local advisory centre before giving heavy applications of lime. The best temporary measure of control, and one that must be repeated annually, is to raise the seedlings in sterilized soil and dip their roots, before planting, in a calomel paste made by mixing 3 lb of 4 per cent calomel dust with one pint of water. Bunches of about a dozen plants can be dipped at the same time, and the above quantity is sufficient to treat about 250 plants. Club root is also kept down by making use of an adequate system of crop rotation.

Canker

This is caused by the fungus *Phoma lingam* (Fr.) Desm. and may occur on all brassica crops. It takes the form of light brown to purplish lesions on the stem and tap root, and is frequently associated with spotting of the leaves. The fungus may persist in the soil for several years; therefore it is essential to burn all diseased refuse and to choose as seedbed, soil which has not carried brassica crops for a time. Cabbages should preferably not be planted in the same field more than once in four years. The disease may also be seed-borne.

Downy Mildew

This may be troublesome on brassica seedlings raised under glass, and may develop later on the sprouts of Brussels sprout plants. In the case of the seedlings the attack is aggravated by insufficient ventilation. Care should be taken to give full air to the seedlings growing in frames or glasshouses. The disease can be controlled by spraying in the seedling stage with Bordeaux mixture.

Damping-off and Wire Stem

Damping-off is often caused by the fungus *Corticium solani*. The roots and stem bases of seedlings are attacked so that they topple over and die. An attack by the same fungus on older plants may result in shrinking, browning and hardening of the stem bases, a condition described as "wire stem". These plants are often killed; they may recover, however, but are weakened and the stems break easily. Some control may be given when mercuric chloride is watered on to seedlings in the rough leaf stage at 1 oz per 12½ gal water.

Virus Diseases

These are common in most districts and often cause severe damage. The two commonest occurring are cauliflower mosaic (Advisory Leaflet No. 370) which causes dark green mottled areas on the leaves, and cabbage black ring spot which causes light coloured spots, surrounded by a black necrotic ring. These diseases are carried from infected to healthy plants by aphids. The most satisfactory control measures are isolation of the seedbeds, rotation of crops and

avoidance of overlapping brassica crops, clean cultivation, and spraying or dusting with nicotine preparations to control aphids.

Equipment Required

The minimum equipment for effective pest control on the average size market-garden would be a rotary dust gun, a pressure knapsack sprayer and a hand atomizer. On large concerns small power units of all three types of equipment can be employed. For the application of small amounts of spray liquids a modification of the knapsack sprayer is mentioned under cabbage root fly (see page 21).

Precautions

Precautions that must be observed by users of organo-phosphorus insecticides are laid down in the Agriculture (Poisonous Substances) Regulations, 1953, and the Agriculture (Poisonous Substances) (Amendment) Regulations, 1953. Users should read the Ministry's Leaflet A(PS)1, Precautions in the use of Weedkillers and Insecticides containing Dinitro and Organo-Phosphorus Compounds, which includes summaries of the main provisions of the Regulations. Employers should ensure that they are aware of their obligations under the Regulations.

Rabbits and Hares

Where these are a nuisance and cannot be controlled by other means, the fields should be fenced with galvanized wire netting, 4 ft in width, with 1½ in. mesh, securely fastened to strong stakes 6 ft in length, which should be pointed and creosoted at one end to go into the ground.

A furrow, which is turned inwards towards the plantation, is taken out round the boundary of the field. The stakes are driven 18 in. down at intervals of 16 ft. The netting is fixed to the outside of the stakes, leaving the bottom 6 in. free, which is bent outwards. A second furrow is ploughed over the first burying this wire netting, which leaves a fence 3½ ft high. A single strand of barbed wire or strong hedging wire is stretched 4 in. above the netting, from one stake to the next, and at intervals the netting is strained to this wire with thinner wire to prevent sagging. The single wire, which should be well strained, will also act as a check to attempts by the animals to jump the fence.

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* Copies of the leaflet may be obtained free from the Ministry of Agriculture, Fisheries and Food (Labour Division), St. Andrew's Place, Regents Park, London, N.W.1.

Local Practices in the Main Production Areas

Spring Cabbage and Spring Greens

Bedfordshire

Many of the spring greens and spring cabbage crops are drilled between the 24th July and the 7th August and chopped out. The earlier date is chosen for the heavier soils, the latter for light soils. The resulting plants are chopped out to leave the plants at 4–5 in. apart. If the plants are thinned to a greater distance than 6 in. they form a square shoulder and are not ready to cut so soon. Some growers leave a group of plants at each station and some of the small growers drill part of the acreage and then thin the plants to 6 in., using the thinnings for transplanting elsewhere. To provide for the demand for greens, seed is drilled from June onwards and cutting commences in October and continues through open weather. Varieties used are 'Imperial', 'Early Offenham', 'Durham Early' and 'Wheeler's Imperial'.

Cheshire

Spring cabbage is an important crop in the Wallasey district of the Wirral peninsula. The soil is a light, sandy loam with a high water-table and the crops mature very quickly. Cutting of "greens" begins in November and the whole crop is cleared by the first week in April, as it is the object of the growers to supply the early market only and to finish before supplies from the Ormskirk district of Lancashire begin. In the Wallasey district, the crop is often planted on raised beds or butts 4 ft wide; five rows of plants are planted on each butt, the plants being 9 in. apart in the rows. In this district the crop is not often sown *in situ* but is transplanted from the end of August to early October, from seed sown on or about the 21st July. Most growers use their own strains but varieties commonly grown are 'Harbinger', 'Flower of Spring' and 'Clucas No. 1'.

Cornwall

This county caters for the early market for hearted spring cabbage, which fills the gap in supplies of winter cauliflower due to the slowing up of curding by cold weather. When brassica supplies are short the fields are cleared and marketed in a semi-hearted state.

Seed is sown from mid-July to early August, the varieties mostly used being 'First Early Market' and 'Offenham'. Very close planting out is practised (12 × 9 in.) and in some areas crops are slightly banked, as both give protection from damage by high winds.

Heavy dressings of quick-acting nitrogenous manures such as potash nitrate, nitrate of soda or sulphate of ammonia are given. A very high rainfall coupled with warmer soil conditions make this practice less dangerous than it would be in other areas, although adequate potash must be applied to increase winter hardiness.

Owing to the long distance cabbage from this county has to travel, wooden winter cauliflower crates are used and may carry anything from two to four dozen heads.

Essex

Spring greens are drilled direct in the field at the end of July or early August for chopping out, the rows being 18 in. apart. For spring cabbage production the seed is sown in a seedbed between 1st and 14th August in rows 12 in. apart for transplanting in September. Varieties in common use are 'Durham Early', 'Wheeler's Imperial', 'Ellam's Early', 'Early Offenham' and 'Flower of Spring'.

Hampshire

This crop is grown mainly for cutting as hearted cabbage though some is marketed as spring greens. The largest acreages of spring cabbage are centred round Swanwick, Botley and Burlesdon, Alton, Ringwood and Romsey; and are on a variety of soils ranging from light sands to heavy loams. The varieties usually grown are Durham Early, Early Market, Wheeler's Imperial, Spring Tide and Flower of Spring. Seed is sown from the last week in July to the first week in August, the larger growers making three sowings between 25th July and 8th August. Planting out varies with district; the very early districts of Burlesdon and Warsash plant out some time towards the end of August.

Kent

In this county hearted spring cabbage is produced mainly in the Ash, Thanet, Sandwich and Swanley market garden districts, while spring greens are more general on the large farms in the Hundred of Hoo. Seed is sown from 25th July to 7th August, and transplanted in late September to early October, but much of the crop is grown *in situ* and chopped out. The variety used is mainly 'Early Offenham'.

Lancashire

Spring cabbage is grown in Lancashire, principally on the sandy loams in the Ormskirk area, but is also to be found on the moss soils between Preston and Southport, and between Warrington and Manchester. Where spring cabbage is interplanted between maincrop potatoes, a complete fertilizer at the rate of 15 cwt per acre is applied between the rows before a rucker (p. 29) is run between the potatoes. A heavy dressing of basic slag is commonly applied before seed sowing. The seed is usually drilled or broadcast in butts about 20th July, and planting out takes place in late August and throughout September; 10–12 in. × 24–28 in. are the usual spacings. Sometimes the plants are wintered in the seedbed and planted out in March, especially on the moss soils, and also in other districts to provide succession. Some growers drill in rows 28 in. apart and thin out to 20 in. apart, using the thinnings for transplanting. Cutting is usually commenced in March or April, as soon as the supply of savoys fails, and is continued until June. The varieties grown are 'First Early Market' and 'Durham Early', especially the former owing to its size and rich dark green colour. Some growers save their own seed from selected plants, while a number of local seedsmen specialize in their own selections.

Lincolnshire

Spring cabbage has been an important crop in the Boston area for over 70 years; 'Offenham' types are grown as a second crop after early or second early potatoes on about 3,000 acres. Growers sow seed during the second half

of July for planting out during September to the end of October. The bulk of the crop is marketed as greens and those unsold as such — according to market demand — grown on into hearted cabbage. Yields range between 3 tons per acre for early greens to 12 ton per acre for hearted cabbages.

Middlesex

Seed is sown from 14th to 20th July followed by a second sowing 10 days later. Normally plants from the earlier sowing are preferred both for spring greens and spring cabbage. The resulting seedlings are transplanted at the end of September and into October, but late October plantings may winter badly. About a fifth of the spring cabbage crop is drilled to stand, and after pulling plants for transplanting the remainder is allowed to run on for spring greens. Selected strains of 'Early Offenham' are most favoured.

Northumberland and Durham

Seed is sown during the second week of July and the plants set out in their permanent quarters at the end of August. Drilling to chop out is not often practised. Some growers raise their own stock of seed from selected plants of the varieties 'Newcastle Market', 'Durham Early', 'Early Market' and 'Leeds Market'. When preparing the land for the crop a "scrubber" is used to obtain a fine tilth. Marketing the crop starts with spring greens in late February or early March.

Worcestershire

Spring cabbage is grown mainly on the light land areas bordering the river Avon and east of the Severn, and is generally marketed as spring greens from mid-February until April, although a little may be cut as early as Christmas. Some fields are left for cutting as hearted cabbage in May and June. Seed is sown during the first 14 days of July and transplanted from late August to early October; spacing is commonly 20 × 8 in. For drilling to chop out, seed is sown from mid-July to mid-August but mostly during August, i.e., one month later than for transplanting. Most large growers save their own seed of selected Offenham types.

Summer and Autumn Cabbage

Essex

Summer cabbage is grown on light to medium soils throughout the county, mainly bordering the Thames estuary with Rainham as a centre and in the Stour valley to the north of Colchester. The earliest summer cabbage follows such crops as winter-sown green onions, early lettuce or radishes. 'Primo', 'Golden Acre', 'Utility' and 'Winnigstadt' are the varieties mostly used and Christmas Drumhead as an autumn cabbage. Seed is drilled direct in the field from mid to late March according to the heaviness of the land and the plants are chopped out. In the Rainham area a certain amount of early summer cabbage (Primo) is raised by sowing under Dutch lights in January and planting out in March.

Kent

The principal area in the county for summer and autumn cabbage is in the north-west around Swanley and Gravesend. Seed sown in January (under

glass) and planted out in late March provides the earliest crops, which are followed by those from seed sown outside in late March and early April. Planting is carried out from late April to mid-May, the rows being spaced 21–24 in. apart and the plants 15–18 in. apart in the rows.

Middlesex

The main area for this crop is in the south-west of the county on the brick-earths and alluvial soils. Summer cabbage varieties used are 'Primo', 'Non-pareil', 'Velocity' and 'Winnigstadt'; and 'Christmas Drumhead' is marketed from October to December. 'Primo' and 'Velocity' are usually sown broadcast in frames during January and February for planting out in March and April. Later sowings are drilled in the open about the end of March and chopped out.

Yorkshire

The main producing areas are centred round Leeds, Wakefield, Doncaster, Pontefract and York. The types of soil on which this crop is grown vary from heavy clays to sandy and medium loams. Formerly dung or night soil was applied to the land during its preparation, recently sewage sludge has been more commonly used, very heavy dressings being applied to the lighter soils. The main varieties used are 'Primo' types followed by 'Winnigstadt' and 'Utility'. Seed is sown from March to early May, the earliest sowing being in March in cold frames. Planting is carried out during June and up to 20th July, this date applying to the more southerly and easterly parts of the county. In the Leeds-Wakefield area planting out cannot usually be extended beyond the first week in July. Drilling cabbage direct in the field is not popular in the West Riding. 'Leeds Market', which is marketed after spring cabbage, is sometimes sown in autumn and overwintered in the seedbed, when it is planted out in early spring.

Bedfordshire

Winter cabbage is grown in all the market garden areas and often follows the earliest crops of potatoes and peas. Manuring is usually 8–10 cwt per acre of a potato compound fertilizer before drilling or planting.

'Christmas Drumhead' is usually ready for cutting by the end of August and continued until December. It is often drilled direct in the field in April and May and chopped out. 'January King' follows being drilled in May and up to early June and chopped out, or in the smaller areas transplanted up to the end of July.

Essex

The crop is grown mostly on the heavier soils round the coast. If planted out it follows any well-manured crop in the normal market-garden rotation; if drilled and chopped out it follows a bare fallow. The seed is drilled in a seedbed at the end of April, and planting out at 24–25 in. is done at the end of July or beginning of August; alternatively it is sown direct in the field in early May for chopping out.

Kent

The largest production is in the north of the county in the area stretching from Dartford to Faversham, and around Ash and Sandwich. The varieties used are usually 'Christmas Drumhead' and 'January King'. Seed is normally

sown in mid-April for planting out in June and early July, while for late crops of 'January King' seed is sown in early May and planted out in late July.

Savoy Cabbage

Bedfordshire

Late savoys such as 'Ormskirk Late' and 'Alexander's Late' are usually sown in mid-May and planted out at the end of July, but they also may be drilled and chopped out. With all varieties the row width is usually kept at 24 in. and the distances between the plants in the row vary from 15–24 in.

Hampshire

The largest areas under savoys are in the Wickham and Botley district, around Alton and Ringwood, and near Bournemouth. This crop is grown on a wide range of soils. The varieties generally used are 'Ormskirk Early', 'Best of All', 'Ormskirk Medium','Ormskirk Late Green', 'Latest of All', 'Omega', 'Alexander's No. 1' and 'Rearguard'. The early varieties are sown at the end of April and later ones in late May, and are set out during June and July.

Kent

Savoys are grown mostly in the north and east of this county, as with other brassicas. Seed is sown in early May for planting out later in July, the first week in August being regarded as the latest time for planting.

Lancashire

This crop is extensively grown in the county particularly in the black land district, frequently interplanted with early potatoes of erect growth. When grown as a self crop seed is sown in early August, planting out is done in March and the crop is cut in September. When grown as an intercrop, seed is sown in seedbeds in the open in late March or early April, and the plants are set out at 18 or 24 in. apart in the furrows after the final earthing up of the potatoes at the end of May or early June. A rucker is drawn down the furrows before planting. The rucker carries a semi-horizontal share which scoops up the earth, and behind is a perpendicular spade. Its object is to form successive heaps of earth in the furrow known as cobs. The plants are inserted on the cobs from which excessive moisture drains away into the furrow. In order that the savoys may make good growth the potatoes must be lifted by the middle of July, although it is a disadvantage if the market is slack. Nitrate of soda is applied at the rate of 1–2 cwt per acre at the end of July or early August, a second application being given if growth is slow. The plants are slightly earthed up after the fertilizer has been applied.

Brussels Sprouts

Bedfordshire

This crop is grown in nearly all parishes in the east and north-east of the county, the largest areas being centred round Great Barford, Roxton, Eaton Socon, and Biggleswade and Northill districts, where the soils vary from gravel to heavy boulder clay. A considerable acreage is also grown on the lighter Greensand soil round Potton, Flitwick, Maulden and Clophill. The most successful crops of the best quality are generally on the medium and heavy soils.

Most sprouts in this county are local selections, and a medium tall, late, dark green sprout is favoured. Many growers either save their own seed or buy locally from other growers. Seed is sown from February to March, usually in drills 12 in. apart, the earliest sowings being made in sheltered places. A few growers make sowings under Dutch lights or cloches in January or February. Planting out is started in May and growers on the heavy land usually make particular efforts to plant out early. Most of the planting has been completed by mid-June. A little planting is done with autumn raised plants sown at the end of August or early September, over wintered and then planted out during April. On heavy land during pre-planting cultivations, some growers plough in soot and also use it as a top dressing when plants are 8–10 in. high. Generous top dressings of nitrogen are given where only compound fertilizers have been used before planting, and it is now quite common to give 4 cwt per acre of Nitro-Chalk in early July and a further 4 cwt per acre in late August.

Sprout tops are marketed from the end of October onwards if there is a reasonable demand in the market for them. Cocking is also practised, only a small part of the growing tip being removed to speed up buttoning without reducing yield appreciably (see page 18).

Cambridgeshire

Brussels sprouts are grown on the medium chalky loams and clays in the west and south-west parts of the county which border on the counties of Huntingdon, Bedford and Hertford. The crop usually forms part of the general farm or market-garden rotation. A limited acreage of the standard varieties sold by seedsmen are grown, but the dark green 'Ashwell' type is by far the most popular and there are a number of really good selections from this in the hands of commercial growers. Many growers save their own seed, and have worked up some really good stocks. Most of the seed is sown in drills 12 in. apart in a seedbed in early March but a limited quantity is sown in the early autumn to provide plants for early planting. This early planting often misses the dry weather and helps to spread the load at planting time. The plants are set out a yard square from April until June but closer planting is sometimes practised for the small canning and quick-freeze types such as 'Cambridge Special'.

Gloucestershire

Most of the Brussels sprouts are grown in and around the Chipping Campden district on the hills on oolite limestone soil which gives the best quality sprouts. A smaller acreage is grown in the Evesham Vale, this soil being mostly lias clays. Most of the crop is grown either by farmers who sell the standing crop by auction, or by market growers or merchants who hire the land from farmers. Most growers use local selections which are particularly suited to the soil conditions, 'Rous Lench' being a popular variety on the heavier land in the Evesham Vale. Plants are raised from autumn or spring sowings in the open or much more often by winter sowing under glass. Sowing in nursery beds outdoors is at the end of August and early September for planting in March; or in mid-February to early March for planting in May to mid-June. Most growers in this county, however, sow under glass, drilling seed in the borders in cold tomato houses at the end of October to early November, and thinning or pricking out when the plants are large enough, usually starting in early

February for planting by the middle of April. Where growers have no houses they either buy in plants or rent cold houses from November to the end of March. Where the grower owns the land compound fertilizers are worked in during land preparation before planting. With hired land these fertilizers are seldom if ever added, because of the residual manurial values remaining in the soil after the contract has expired. Cocking is carried out in August when the plants show signs of buttoning. The sprout season extends from early September (from glasshouse grown plants) to February, the bulk picking being from October–November.

Hertfordshire

Hertfordshire has the fourth largest acreage of Brussels sprouts. The greatest concentration is in the north of the county around Hitchin, Baldock and Ashwell. There is a smaller concentration around St. Albans, Welwyn and Harpenden. In the north the soils are mainly chalky clays but further south they are less chalky and lighter. Most of the sprouts are grown by farmers who fit them into their farm rotation. The growers who specialize in this crop often have their own stocks.

Lancashire

The growing of Brussels sprouts is centred largely in the Ormskirk and Hesketh Bank areas, the latter being on reclaimed land. When sprouts follow clover, after cutting the second clover crop the land is ploughed deeply in November or December, in spring being disced and rough harrowed. Farmyard manure and a complete fertilizer are spread in shallow drills which are drawn 28 in. apart. As soon as the land is workable in spring, these manured furrows are then covered and pointed up, and saddle-back harrows are run over the furrows at the end of March or in April, in order to destroy the first growth of weeds. When sprouts follow potatoes the land is first prepared and manured in the usual way, and then furrowed up in the spring as already described. The varieties chiefly grown are 'Early Champion', 'Timperley Champion', 'Masterpiece' and 'Latest and Best', while some growers save seed from their own selections. Seed is usually sown during the third week of March (21–23), and the plants are set out towards the end of May to June. When sprouts form part of the general farm rotation it is a common practice to plant two rows of sprouts and drill a row of peas which are alternated across the field.

Worcestershire

This crop is grown in the Evesham-Pershore area, on the hill farms on the Gloucester-Worcestershire border and in areas bordering the Severn valley. Soil types vary and include lias clay (considered to be one of the best soils), heavy sands, gravels and marls. In the Evesham area the sprout crop often follows spring cabbage and precedes peas, while on the lias clay sprouts are often grown many crops in succession on the same land. The dwarf 'Bretforton' type is sometimes used to intercrop young or worked out asparagus beds or early maturing crops such as French beans. In the south of the county growers' own selections of sprouts, which vary greatly, are used almost entirely. Evesham types are also largely grown, the later maturing varieties being largely confined to the hills in Gloucestershire. Though some seed is still sown in August, most of it is sown in the open in late February or early March. In specially early

districts growers often use frames, sowing in mid-February. Planting out proceeds from April to late May. The first pickings are made from the 'Bretforton' type in late August, the bulk of the crop being harvested from September to mid-January.

Yorkshire

This crop is largely centred round York, Selby, Pontefract, Leeds and Wakefield on soils which vary from sandy and medium loams to heavy clays in the Leeds-Wakefield district. 'Cambridge No. 5' is now the most popular variety, though 'Dalkeith' is useful for growing in exposed positions. In this county seed is normally sown in the autumn, overwintered in seedbeds, and planted out early in the following May.

Appendices

Appendix I

Calendar for the Production of Cabbage and Savoy throughout the Year in the South

The following table illustrates the possibility of producing cabbage and savoy for a continuous supply throughout the year in the south of England. In addition to the varieties suggested, others suitable for the purpose (see page 1) may be preferred in some districts. The dates for sowing and transplanting or sowing and "chopping-out" are approximate and will vary widely with climate and locality (see pages 4–5).

As it is not commercial practice to produce cabbage throughout the year in the north of England, no table similar to that for the south can be given. Further cultivation details have been included under the various counties on pages 25–29.

Month for cutting	*Kind*	*Varieties*	*Month of*	
			Sowing seed	*Planting out*
January	Winter Cabbage	January King	Mid-May	Mid-July
	Savoy	Alexander's No. 1, Omega, Ormskirk Late	Early May	Mid-July
February	Winter Cabbage	January King	Mid-May	Mid-July
	Savoy	Alexander's No. 1, Omega, Ormskirk Late	End May	End July
March	Savoy	Omega, Ormskirk Late, Ormskirk Extra Late	End May	End July
	Spring Greens	Early Spalding, Spring Glory, etc.	Late July Early August	September* "Chopped out"
April	Savoy	Ormskirk Extra Late	Early August Mid-August	Mid-September* "Chopped out"
	Spring Greens	Early Spalding, Spring Glory, etc.		
	Spring Cabbage	Harbinger	End July	Mid-September*
May	Spring Cabbage	Harbinger, Early Offenham, Spring Glory	End July Mid-August	Mid-September "Chopped out"
June	Spring Cabbage	Early Offenham, Spring Glory, Durham Early, etc.	End July	End September
	Summer Cabbage	Primo, June Giant	January (in frames)	Late March and April
July	Summer Cabbage	Primo, June Giant, Golden Acre	Early March	April
August	Summer Cabbage	Golden Acre, Greyhound	April	May
	Autumn Cabbage	Winnigstadt		

* Planting should be completed by 25th October.

Month for cutting	*Kind*	*Varieties*	*Month of*	
			Sowing seed	*Planting out*
September	Autumn Cabbage	Winnigstadt	End April	Early June
October	Autumn Cabbage	Winnigstadt	End April	Early June
	Winter Cabbage	Christmas Drumhead		
	Savoy	Green Curled, Best of All	Early May	Mid-June
November	Winter Cabbage	Christmas Drumhead, January King	Early May Mid-May	End June "Chopped out"
	Savoy	Green Curled, Best of All, Ormskirk Early	Mid-May	Early July
December	Winter Cabbage	Christmas Drumhead, January King	Mid-May End May	Early June "Chopped out"
	Savoy	Ormskirk Early Ormskirk Medium, Alexander's No. 1	Early May	Mid-June

Appendix II

Approximate Number of Plants required per Statute Acre (4,840 sq. yd)

Row Width (inches)	*Distance between Plants (inches)*					
	9	12	15	18	21	24
12	58,100	43,600	34,900	29,100	24,900	21,800
15	46,500	34,900	27,900	23,300	20,000	17,500
18	38,800	29,100	23,300	19,400	16,600	14,600
21	33,200	24,900	20,000	16,600	14,300	12,500
24	29,100	21,800	17,500	14,600	12,500	10,900
30	23,300	17,500	14,000	11,700	10,000	8,800

Appendix III

Other Ministry Publications on Cabbages and Related Subjects

Bulletins

No. 71 Soils and Manures for Vegetables, 5s. (5s. 5d. by post)
No. 123 Diseases of Vegetables (*In the press, July 1960*)
No. 131 Winter Broccoli and Summer Cauliflowers (*In the press, July 1960*)
No. 138 Irrigation, *4s. 6d.* (*4s. 11d. by post*)

Copies are obtainable from H.M. Stationery Office at any of the addresses on the back cover page.

Advisory Leaflets

No. 18 Cabbage Root Fly
No. 69 Cabbage Caterpillars
No. 109 Flea Beetles
No. 115 Slugs and Snails
No. 179 Leatherjackets
No. 225 Cutworms
No. 269 Cabbage Aphid
No. 370 Cauliflower Mosaic

Single copies of these leaflets, up to a total of six, can be obtained free from the Ministry of Agriculture, Fisheries and Food, Leaflet Room, Ruskin Avenue, Kew, Richmond, Surrey. Further copies can be purchased from H.M. Stationery Office, price 3*d*. each net.

Marketing Guides

No. 6 Brussels Sprouts
No. 9 Cabbage Greens and Cabbage, Savoy Cabbage and Red Cabbage
No. 15 Globe and Jerusalem Artichokes, Witloof Chicory, Horseradish, Purple Sprouting Broccoli and Curly Kale.

These Guides can be obtained free from the Ministry of Agriculture, Fisheries and Food, Leaflet Room, Ruskin Avenue, Kew, Richmond, Surrey.

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No. 36.	Manures and Fertilizers	5*s.* 6*d.* (*post* 6*d.*)
No. 71.	Soils and Manures for Vegetables	5*s.* 0*d.* (*post* 5*d.*)
No. 94.	Potatoes	3*s.* 6*d.* (*post* 4*d.*)
No. 131.	Winter Broccoli and Summer Cauliflower	2*s.* 6*d.* (*post* 4*d.*)
No. 138.	Irrigation	4*s.* 6*d.* (*post* 5*d.*)
No. 179.	Seedlings of Common Weeds	4*s.* 6*d.* (*post* 6*d.*)

These publications are obtainable from
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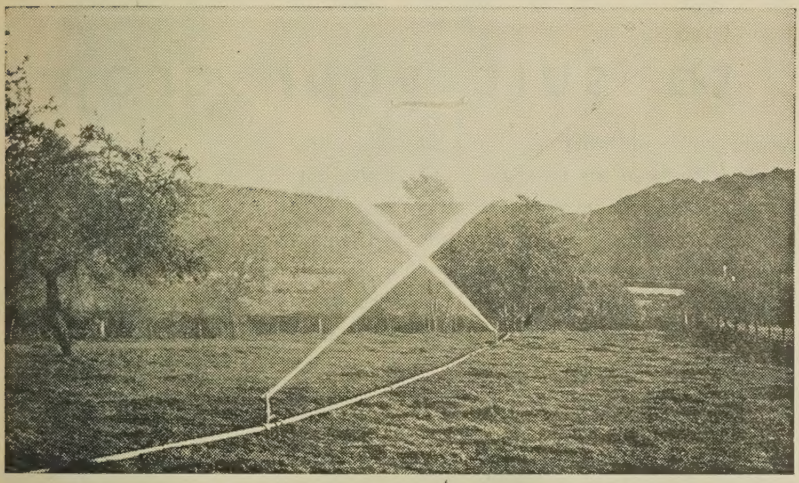

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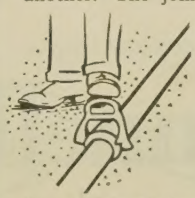

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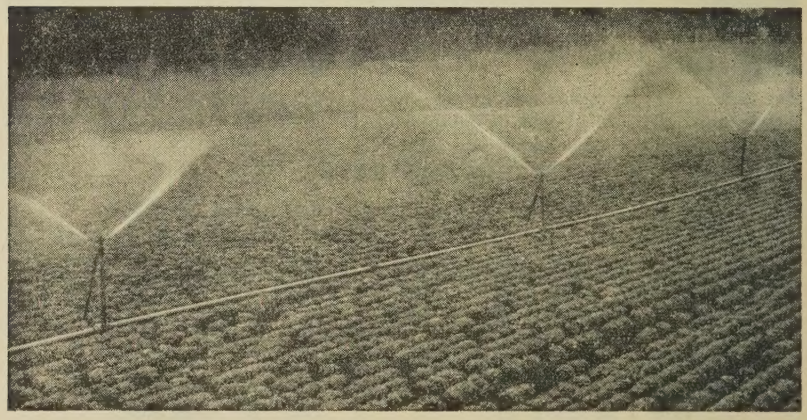

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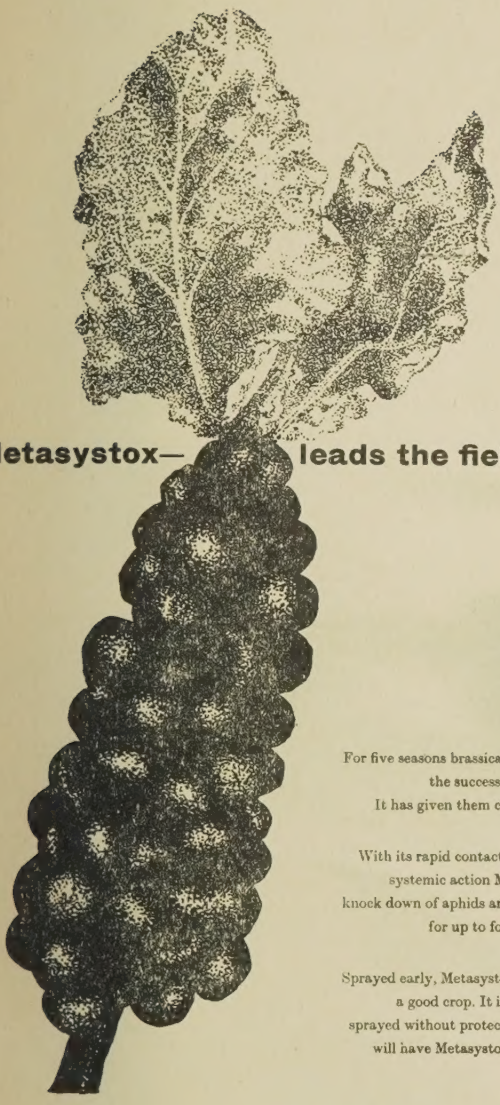

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